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Description of Instruments and
Mode of Signalling
USED IN
—†HARPER'S†—
PATENT
MAIN SIGNALLING APPARATUS,
FOR WHICH
A MEDAL
AND
CERTIFICATE OF MERIT
WAS AWARDED
At the Exhibition of Means and Appliances for the Protection
and Preservation of Human Life of 1882,
ALSO OF
—†STROUDLEY'S†—
PATENT
INTERCOMMUNICATION IN TRAINS.
—
Sole Manufacturers,
GARNHAM & CO.,
SASH COURT,
WILSON ST., FINSBURY, LONDON.



GARNHAM & COMPANY, *Lond*

ELECTRICIANS AND TELEGRAPHIC ENGINEERS,

CASH COURT, WILSON STREET, FINSBURY,

LONDON, E.C.,

Sole Manufacturers of

HARPER'S Patent Interlocking Block Telegraphs,

FOR THE PREVENTION OF ERRORS IN SIGNALLING TRAINS,

*in use on the Lancashire and Yorkshire, London Brighton and South
Coast, London and North Western, Midland Great Western of
Ireland, Dublin Wicklow and Wexford, and Sligo, Leitrim
and Northern Counties Railways.*

ALSO

ETROUDLEY'S Patent Intercommunication in Trains.

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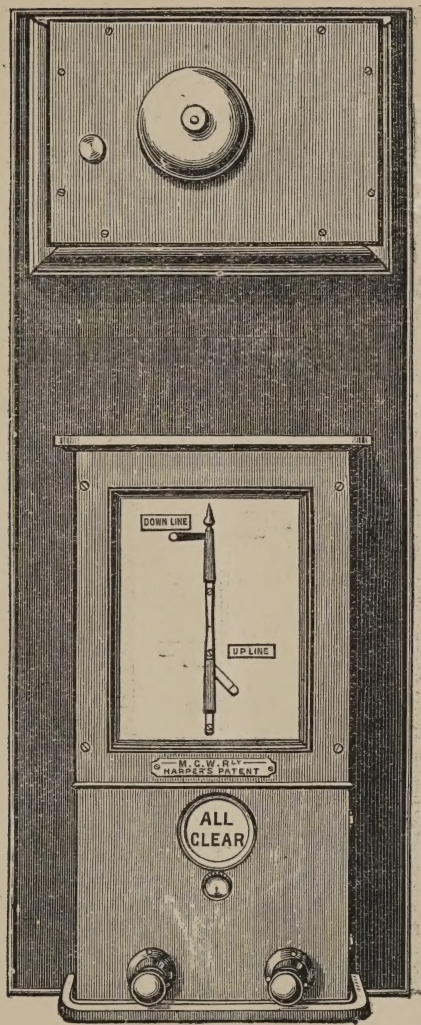
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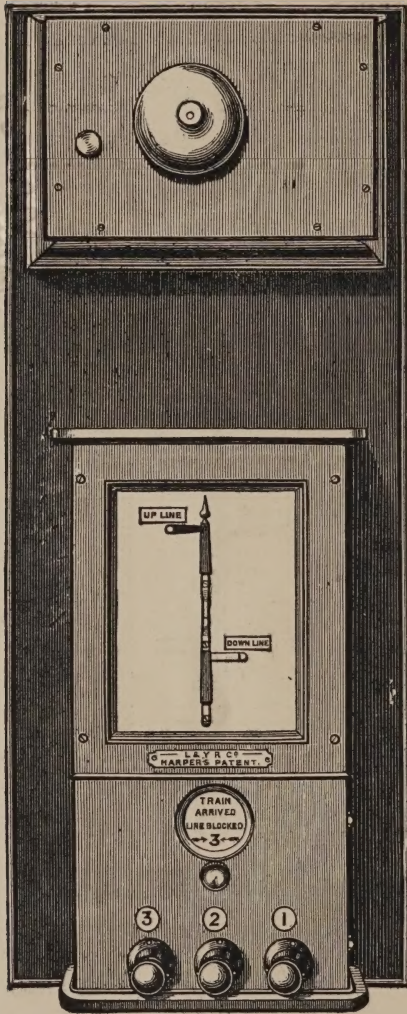


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INSTRUMENT IN USE
ON THE
MIDLAND GREAT WESTERN OF IRELAND, THE
DUBLIN WICKLOW AND WEXFORD, AND
THE SLIGO, LEITRIM AND NORTHERN COUNTIES
RAILWAYS.

P 58662



INSTRUMENT IN USE
ON THE
LANCASHIRE AND YORKSHIRE, AND MIDLAND
GREAT WESTERN RAILWAYS.

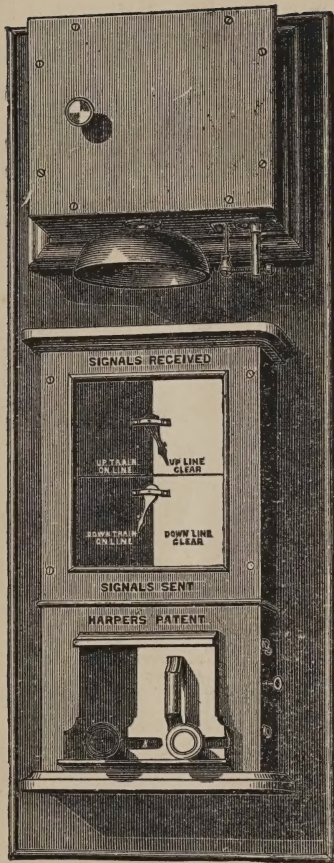


FIG. 1.

Instrument used for Ordinary working, by Lancashire
and Yorkshire, and London and North Western
Railways.

THE FOLLOWING IS A BRIEF DESCRIPTION OF

HARPER'S PATENT TRAIN SIGNALLING APPARATUS.

THE annexed engravings will show the peculiar advantages of the above Patent Signalling Apparatus.

In all One Wire Systems, the Bell Signals between Signal Stations must be given on the same Plunger or Key that the last Signal was sent on. Now, if the Signalman should by mistake press the Line Clear Plunger in sending Bell Signals, instead of the Blocked one, he would clear the Line at the rear of the Train. This has frequently occurred. (See Board of Trade Reports on Railway Accidents). To prevent this, and to give the Signalman a positive record of what he last done, the Instrument here offered was designed whereby it may always be seen at a glance the last Signal sent to the Signal Station at the rear, and as the Interlocking principle is by means of a slotted bar, any number of Plungers, Keys or Tappers may be locked up, leaving only those free that cannot give conflicting Signals.

The Up and Down needles or arms are placed on different halves of the dial—the top half of the dial showing the Signals received from the distant Station, the bottom half showing the Signals sent, whilst from the peculiar Safety Locking Apparatus which is introduced, it is impossible for the wrong Signal to be sent by inadvertence; in fact, these Signalling Telegraphs combine the greatest possible safety in working with simplicity of construction. One line wire only is required for the system, which can be worked by any battery arrangement having a low internal resistance, the needles or arms being totally unaffected by vibration, they therefore cannot fall away from their pins on the dial.

The introduction of the Locking Plate to the instrument entirely supersedes the use of a separate Ringing Key. This renders this system far less complicated than any other Single Wire System.

It is impossible that a signalman can alter or in any way tamper with these instruments either wilfully or inadvertently; even in the event of a needle or miniature semaphore arm being held back maliciously during the transmission of a signal, the correct signal will be recorded on the dial immediately the impediment is removed, showing at once the direction in which the last current was sent through the coils of the apparatus.

We claim for these Instruments a greater amount of safety, durability, economy and efficiency, *than any other "One" Wire Block System of Signalling.*

DESCRIPTION OF INSTRUMENTS AND MODE OF SIGNALLING,

As used by the Midland Great Western of Ireland, the Dublin, Wicklow and Wexford, and the Sligo, Leitrim and Northern Counties Railways.

THE Dial of the Instrument is divided into two parts—one part being for the Up Line, and the other part for the Down Line. There are two miniature Semaphore Arms—the upper one colored **Red**, and the other **White**. These arms work up and down, after the manner of the Out-door Semaphore Signals. The upper or Red Arm is worked from the next Signal Box in advance by electricity, and practically corresponds with the position of the Out-door Distant Semaphore Arm of that Box. The lower or White Arm is raised or lowered (by pressing in the Plungers on the Instrument in the Box) in exact correspondence with the movement of the Red Arm in the next Signal Box.

Underneath the Dial is a circular glazed opening in the Instrument Case, through which the lettering upon a moveable Disc may be read—the THREE following inscriptions appearing in succession :

- a. On White Ground—**All Clear**.
- b. On Red ground—**Train on Line**.
- c. On Green ground—**Train off, but Section Blocked**
(normal position).

The Disc is moved by a brass knob immediately below the opening ; which also, at the same time, by means of the slotted bar contrivance, frees one or other of two Plungers or Keys underneath the Knob.

The right-hand Plunger is colored **White**, and, when pressed in, the lower arm on the Dial above it, and also the upper arm on the Instrument in the next box, is *lowered* to “All Clear” in acknowledgment of the “Be Ready” Signal. The left-hand Plunger is colored **Red**, and, when pressed in, the lower arm on the Dial above it, and also the upper arm on the Instrument in the next Box is *raised* to “Danger” in reply to the “Train On” Signal.

NOTE.—*Signals given on the Red Key Block the Line in the rear ; Signals given on the White Key Clear the Line in the rear. The position of the Semaphore Arms is not affected by any Signals which do not block or clear the Line, when given upon either key that is free at the time it is pressed in.*

The Red Arm shows the last “block” or “clear” Signal **received** at the Station, and the White Arm the last “block” or “clear” Signal **sent** from the Station.

Each Instrument is also fitted with a Ringing Coil—viz., a Bell for the Up Line, and a Gong for the Down Line.

Whenever the Red Semaphore Arm is moved, or any Signal given from the next Signal Box, the Bell or Gong will sound.

The Instruments are to be kept free from dust, dirt, or grease, &c., and to be thoroughly cleaned not less frequently than once a week.

As it is of the utmost importance for the proper working of the Electric Signals, that nothing of any sort should be placed upon or beside the batteries,—Signalmen are cautioned not to place or permit to be placed, lumber of any description in the battery closets.

INSTRUCTIONS AS TO MODE OF SIGNALLING.—*See Code at end of Book.*

To illustrate :—Train running from Signal-box A to Signal-box B ; and from Signal Box B to Signal Box C :

1. When a Train is about ready to start from a Terminal Station, or on receipt of the TRAIN ON Signal (at Box A) from the Box in the rear for a passing Train, the prescribed Warning Signal, according to the description of Train, is to be given to the Station in advance (B.)

2. If Station B is prepared to receive the Train he will, on receipt of the Warning Signal, move his Disc to "All Clear," and give on his White Key the "All Clear" Signal ○○—○○ in reply, thus lowering the Electric Semaphore Arm at Box A. If, however, the Line is obstructed at Station B, or from any cause the Train cannot be admitted to the section between A and B, the latter will reply to A by giving the Obstruction Signal ○○○○○ on the Red Key, maintaining the Electric Semaphore Arm at B in its raised or normal position.

3. Station A acknowledges B's Signal.

4. On the departure of the Train from the Terminal Station, or of a Stopping Train from an intermediate Station, or as a non-stopping Train is seen approaching (Station A)—if the section a-head is clear, the TRAIN ON Signal is to be sent to the Station in advance (B), viz. : ●●●. Approaching Junctions, the *Branch Line Trains* are to be signalled thus : ●●●●, to enable the Signalman at the Junction to distinguish them from the Main Line Trains, and to arrange his Points and Signals accordingly.

5. Box B moves his Disc to "Train on Line," and then gives *one* beat on his Red Key in acknowledgement, which places Semaphore Arm at Box A at "*Danger*."

6. Box A acknowledges by giving *one* beat on his Free Key, to denote that his Red Arm has risen to "*Danger*."

7. Box B next sends the "Warning" Signal to Box C, and awaits the approach of the Train from the direction of Box A. Box C acknowledges this Signal as directed above.

8. On the approach of the Train, Box B gives the TRAIN ON Signal to Box C, and completes the Signal same as directed above.

9. On the passing of the Train, Box B moves his Disc to "TRAIN OFF—Section Blocked," and gives the TRAIN OFF Signal, *four* beats on his Red Key to Box A, maintaining the Red Arm at Box A at "*Danger*," its normal position.

10. Box A acknowledges TRAIN OFF Signal by giving *one* beat on his Free Key.

11. Box B awaits the receipt of the TRAIN OFF Signal from Box C, which he acknowledges when received.

RECAPITULATION.

Station A gives Warning Signal to B.
 „ B moves his Disc to "All Clear,"
 and acknowledges on his
 White Key, lowering A's
 Arm.
 „ A acknowledges.
 „ A lowers Out-door Signals.

Station A sends Train On Signal to B.
 „ B moves his Disc to "Train On,"
 and acknowledges on Red
 Key, raising A's arm.
 „ A acknowledges.
 „ A raises Out-door Signals.

Station B sends Warning Signal to C.
 „ C moves Disc to "All Clear,"
 and acknowledges on his
 White Key, lowering B's
 Arm.
 B acknowledges.
 B lowers Out-door Signals.

Station B sends Train On Signal to C.
 „ C moves his Disc to "Train
 On," and acknowledges on
 his Red Key, raising B's
 Arm.
 „ B acknowledges,
 „ B raises Out-door Signals.
 „ B moves his Disc to "Train
 Off," and sends Train Off
 Signal on his Red Key to
 A.

All Signals are to be acknowledged, and no Signal is to be considered complete until the reply has been received.

Should a Signal not be replied to it must be *repeated*, until such reply is received from the next Station.

No Private Signals are to be given between Station and Station on any pretence whatsoever, nor is any addition to the Code of Signals to be used without the written authority of the Manager.

All Signals are to be given steadily and distinctly, by the knob of the plunger being pressed well home. The interval between the beats should be *one* second, and between a series of beats a pause of *three* seconds. It is important that the pause between groups of Signals should be distinctly marked, and the Signaller receiving the Signal must allow time for the total number of beats to be given before acknowledging.

GENERAL REGULATIONS

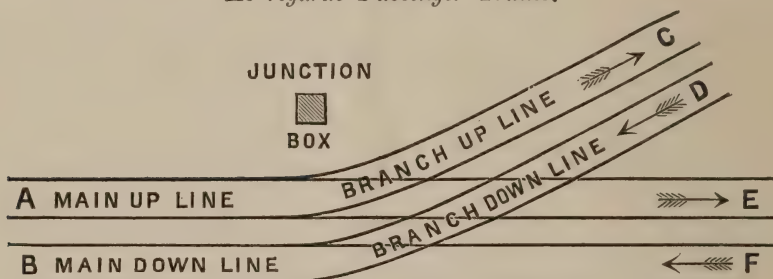
For Working under the Absolute Block System.

The signalling of Trains on the Block Telegraph System does not in any way dispense with the use of Home, Distant, Starting, Hand, or Fog Signals, whenever and wherever such Signals may be requisite to protect obstructions on the railway. The object of the system of Electric Train Signalling is to prevent more than one Train or Engine being between any two Signal Stations on the same line at the same time. This is accomplished by not allowing any Train or Engine to leave a Signal Station until the previous Train or Engine has been signalled as having arrived at or left the Signal Station next in advance.

The Block Signal Instruments and Bells are exclusively for the signalling of Trains, and must not, under any circumstances, be used for conversing, nor for any other purpose than Block Working, in strict accordance with these instructions, and they must only be used by the Signalman or other person specially appointed for the duty.

Rules as to Junction Absolute Block Working

As regards Passenger Trains.



(a) In reference to Trains approaching Junctions the principle must be acted upon, that when either or both Trains convey passengers, and *have to pass without stopping*, they must not be allowed to approach the Junction at the same time on Sections which converge to a fouling point, either by running into one Line or by crossing each other to different Lines.

The foregoing Diagram is given as an illustration :—Whenever a Passenger Train is signalled as having entered Section D, no Engine or Train must be permitted either to pass from Section A to Section E, or to enter Section F; and whenever a Passenger Train has been signalled as having entered Section F, no Engine or Train must be permitted to enter Section D.

(b) In case *either Train has to stop* at a Junction, the Through Train may be admitted to the Section, when the Stopping Train has been

dealt with as specially directed, either by having stopped the latter dead at the Junction Home Signal, or by keeping it at the Signal-box in the rear ; or if both Trains have to stop, they may be allowed with all Signals at Danger to approach the Junction on their respective Lines of Rails as far as the Home Signals, where they must be stopped, and afterwards be allowed to proceed as the circumstances of the case may require.

See Rules 45, 46, and 47.

HARPER'S PATENT INTERLOCKING INSTRUMENTS FOR JUNCTIONS.

SPECIAL attention is directed to the great advantages of these Instruments for use at Junctions—the great feature of the arrangement being that, when a Signaller has cleared the line for a Main Line Train, it becomes quite impossible for him to clear a branch line or siding at the same time, or *vice versâ*, one or the other must be locked, and continue so until the traffic is diverted. This object being accomplished by the slotted mechanical arrangement there is no waste of battery power.

This ensures a greater amount of safety in the working of Junctions than has ever yet been possible under the old system.

The process of signalling the Trains is in accordance with the foregoing Diagram and Instructions, and is to be carried out in strict conformity to the following

RULES:

1. No Engine or Train is to be allowed to pass into a section unless the Electric Semaphore Arm for the section into which it is about to proceed has been lowered, and the section signalled, by the Station in advance, as being clear.

2. Each Signaller is to communicate with the Signaller at the adjoining Box, so as to announce the approach, departure, and arrival of every Engine or Train ; and he is to enter (in ink) upon his Daily Train Record, *every* Signal as it is received or sent. No erasure is permitted—an incorrect entry must only be cancelled by drawing the pen through it, but in such a manner that it may still be read, and the correct entry must be made on the next line.

3. It must be clearly understood that *not more than one* Train is to be on the same line or section at the same time.

4. If two or more Engines require to go between two Signal Stations, they may be permitted to go coupled together at a slow speed, and they may be treated as one Train. They are not to pull up in the Section unless stopped by Signal ; nor must one or more Engines be detached

from the leading Engine until they all pass the Signal-box at the other end of the Section, and then only with the permission of the Signalman on duty at the arrival Box.

The *last* Engine is to carry a tail lamp.

“Warning” or “Be Ready” Signal.

5. In order to give timely warning of the approach of all Trains, and to prevent delay to Passenger Trains, by shunting operations on the Main Lines, the Be Ready Signal, according to the description of Train, must be given to the Station in advance when a Train is about ready to start from a Terminal Station, or at an Intermediate Station, on receipt of the “Train On” Signal from the Station in the rear. The Station in advance, if prepared to receive the Train, will move his Disc to “All Clear,” and give the “All Clear” Signal ○○—○○ on his White Plunger, thus lowering the Semaphore Arm in the next Box. If the Line is not clear, and there be any possible danger at fouling points, the Obstruction Signal is to be given in reply on the Red Plunger, and the Outdoor and Indoor Signals maintained at “Danger” until all obstruction on the Line is removed, when the “All Clear” Signal may be sent on the White Plunger, and the Train be permitted to proceed from the Station in the rear.

6. If the “Be Ready” Signal for a second Train is received at a Box whilst the preceding Train is yet in the Section, the “Be Ready” Signal for the second Train is merely to be acknowledged by *one* beat on the Red Plunger, and entered upon the Record Sheet. When the first Train is out of the Section, and the Train Off Signal for it has been sent to the Box in the rear, the “All Clear” Signal for the second Train may then be given on the White Plunger.

7. When the Be Ready Signal is received, the description of Train and time the Signal was received must be at once entered in the Train Record; and when the Train On Signal is received, the time must then be recorded opposite the description. This will enable a Signalman to know what description of Train is approaching and about to enter the Section, and is a warning to clear the Main Line, by shunting unimportant Trains, in order that no delay or slackening by Signals may be caused.

8. No Train, Engine, or vehicle of any description may be shunted foul of any line on which a Passenger Train is approaching, after the Be Ready Signal for the Passenger Train has been received.

9. No Passenger Train may be shunted upon or across, or may in any way foul a Line upon which another Train of any description is approaching, after the Be Ready Signal for such Train has been received.

10. Ballast Trains are not allowed to stop to load or unload materials between Stations *without first stopping at the previous Station or Signal-box*, and informing the Station Agent or Signalman on duty of the intended stoppage.

“Train On” Signal.

11. After the Train On Signal has been accepted, and the Semaphore Arm at the Station in the rear raised to “Danger,” the Semaphore Arm must not, under any circumstances whatever, be altered until the Train has passed the Station to which it has been signalled, or the Cancelling Signal has been received, intimating that the “Train On” Signal was given in error.

12. On receipt of this Signal for a Passenger Train, care must be taken that no Train, Engine, or vehicle of any description is brought upon or taken across the Main Line or Lines, and that no other obstruction occurs, until the Train signalled has arrived at or passed the Box.

13. In the event of a second Train or Engine arriving at a Signal Station before the preceding Train or Engine has been telegraphed as “Off” from the Station in advance, it must not be allowed to enter the section until the “All Clear” Signal is received, excepting as laid down in Rules Nos. 28, 34, 49, ; but it may go slowly forward as far as the Line is clear towards the Starting Signal, and there remain until that signal is lowered.

“Train Off” Signal.

14. In regard to Passenger Trains, and in regard to all Trains during foggy weather or snow storms, the Line in the rear section must always be kept blocked until the preceding Train has been either shunted clear of the Main Line or has passed the Advance Starting Signal (where such is provided) ; or where there is no Advance Starting Signal, has passed the Home Signal at least 300 yards, and is proceeding on its way in the next section.

15. In regard to Cattle, Goods, Mineral or other Trains not conveying passengers, the rear section must always be kept blocked until the preceding Train has either been shunted clear of the Main Line or has passed the Advance Starting Signal (where such is provided) ; or where there is no Advance Starting Signal, has passed the Home Signal at least 300 yards, and is proceeding on its journey in the next section. Except as follows :—If a Goods or Ballast Train is standing or shunting under the protection of and within the Home Signal, and the Be Ready Signal be received for a following Goods, or other Train not carrying passengers, the All Clear Signal may be given in answer to the Be Ready Signal for it to enter the section. The All Clear Signal may also be given in answer to the Be Ready Signal for a Goods, or other Train not conveying passengers to enter a section when a Goods or Ballast Train is Shunt-or crossing the Main Line under the protection of and within the Home Signal.

16. All Signalmen, before giving the Train Off Signal, must take care to have seen the Tail-lamp of the Engine or Train after its arrival.

This is to provide against danger in case any portion of the Train may become detached on the road, and applies more especially to heavy Goods and Ballast Trains. In the day-time the Tail-lamp on the last vehicle must be seen, as the last vehicle is to carry a Tail-lamp (not lit, except during foggy weather), on all Trains.

Obstruction—"Danger" Signal and "All Clear" Signal.

17. When any obstruction exists upon the Line beyond the protection of the fixed Signals on either side of the Box, or when shunting is being performed, which cannot be fully protected by the Signals, the "Obstruction" Danger Signal must be given, by giving *five* beats on the Red plunger, which will place the semaphore-arm of the next Box at "Danger," if it is not already at "Danger."

The Signalman receiving such Danger Signal, will instantly put his Outdoor Signals to Danger to stop everything from proceeding in the direction obstructed, and he will then reply by giving *five* beats on his plunger.

18. On the removal of the obstruction, the All Clear Signal is to be given by giving *two* beats *twice* on the White plunger, which must be acknowledged by an exact repetition. The Station at which the obstruction existed will then give *one* beat on the Red plunger in reply, to complete the Signal, raising the Red Arm at the next Box to "Danger," its normal position.

19. Whenever, from the breakdown of any Engine or Train, or other similar and unusual cause of obstruction at a Station or on the Line, it may become necessary to block the Up or Down line, or both, the Obstruction Danger Signal is to be given to the next Station or Stations, as the case may require, from which Engines or Trains might approach; and the Electric, as well as the Out-door Signals are to be placed and maintained at "Danger" until the obstruction is cleared. (See also Assistance Signal.)

20. When a Signalman has received a Train On Signal, and has blocked the line behind the approaching Train, and that Train does not arrive at his Box in the usual time, then, should he receive the Attention Signal or any signal on the bell from the Box in the rear, which he does not understand, he should always, under such circumstances, give the Obstruction Danger Signal, so that the Signalman at the Box from whence the Train is coming may know that the Train which he has previously signalled has not arrived, and that the line is still blocked.

21. Should a Departure Signal have been received, and the Train not arrive within the usual time, the Signalman at the Box at which it is due should immediately put on his Out-door Signals for Trains proceeding in an opposite direction, and only allow such to proceed under verbal caution, as possibly an accident, fouling both roads, may have occurred.

22. The Obstruction Danger Signal is, in all cases, to be received in the fullest sense of the word, as a "Danger" Signal, and every effort must be made to stop any Train from proceeding on the road obstructed, until the All Clear Signal has been received.

23. In the event of the Semaphore Arm being out of order, the Obstruction and the All Clear Signals may be used temporarily for acknowledgment to the Train On Signal and the Train Off Signal respectively, instead of the ordinary method, as given in the above Signalling Instructions. So soon as an arrangement *in writing* has been completed between the Signalmen at both ends of the section, the altered code is to be adopted until the written arrangement is cancelled, when the Semaphore Arm is put right. When the Obstruction and All Clear Signals are thus temporarily used for signalling the Trains on the bell only, the use of the Train Off Signal is to be suspended until the Semaphore Arm is again in working order.

24. All Obstruction Signals should be duly recorded after the following manner:—The entry should be made under the line obstructed, whether Up or Down. In the column for the description of Train, the word "Obstruction" should be entered, and under the column "Line Blocked" the time at which the Obstruction Signal has been sent and acknowledged; and when the Obstruction has again been removed, under the column "Line Cleared," the time at which the All Clear Signal has been sent.

25. In the event of one Signalman breaking the Block Signal Rules, and permitting a Train to pass his Box without having got "Train On" acknowledgement for it, the Signalman at the other end of the Section, when he sees the Train approaching him, should at once give the Obstruction Signal, and repeat until acknowledged. When the Train passes he will clear the Section with the "All Clear" Signal (see Rule 18) in the usual way and record the circumstance on his Daily Record, and specially report it to the Manager.

OCCASIONAL SIGNALS.

"Cancelling" Signal.

26. Should a Signal have been missent from any unforeseen cause, the same may be cancelled by giving *six* beats on the Plunger. This is to be acknowledged from the next Box, by the Signalman there arranging his Signals as they were before the receipt of the Signal thus cancelled, and giving *six* beats on the White or Red plunger as the case may require, and *one* beat in return is to be given to complete the Signal. This Signal is sometimes useful, when, from sudden interruption to the regular traffic, Trains are despatched out of time, thereby requiring the former Signal to be cancelled, and a different one to be substituted. The

substituted Signal must be directly acknowledged before a Train or Engine is allowed to advance into the Section ahead. The Cancelling Signal cancels the *last* Signal sent, but the Cancelling Signal is never to be given for the purpose of cancelling a Be Ready Signal, until the Train Off Signal for a previous Train has been received, if a Train was in the Section when the Be Ready Signal was sent in error.

“Special Attention” Signal.

27. In the event of a Signaller observing anything unusual with a Train on passing the Signal-box, such as signals of alarm by a passenger, vehicle on fire, broken axle, or loose tyre, coupling chains unhooked, tail lamps off or light out, goods falling off, &c., &c., and it being very desirable and important to stop such Train at the next Station, he is to call the attention of the Signaller in advance, by giving *seven* beats on his plunger. The Signaller receiving this special Signal will acknowledge by an exact repetition, and immediately show “Danger” on his Home and Distant Semaphore Signals to the approaching Train and stop it. If any part of the Train has been left behind, he will send the Obstruction Signal to the Box in the rear; but if, on the other hand, the Train is found to be complete and the Tail Lamp alone is deficient or not lighted, he will give the All Clear Signal to the Box in the rear. Should the Signaller receiving this Signal have reason to suppose that there is any danger to a Train travelling in the opposite direction, he must also stop that Train and inform the Engine-driver of the circumstances, instructing him to proceed cautiously.

“Train passed without Tail Lamp” Signal.

28. To be given back to the Signal-box in the rear when a Train has passed without a Tail Lamp attached to the last vehicle.

The Semaphore Arm must be left at “Danger” at the Box in the rear; and instead of giving the Train Off Signal, *seven* beats on the plunger are to be given—*five* beats—a pause—*two* beats—and they are to be repeated back from the Signal-box in the rear.

Seven Beats, in two Groups of Five Beats and Two Beats respectively—



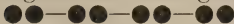
The Signaller at the Signal-box in the rear, who has received this Signal, must stop the next succeeding Train, and warn the Driver and Guard that something may have become detached from the preceding Train, and that there was no Tail Lamp on the last vehicle; and thereupon the Train may be allowed to proceed cautiously to the next Signal-box, and is to be signalled forward thus:—“Train proceeding under Caution Signal” ●●—●●●●●

When the second Train passes out of that Section complete, the All Clear Signal is to be sent, and afterwards the Train Off Signal for the second Train may be given, and the Train Signalling recommenced by the Box in the rear in the ordinary manner. The circumstance must be reported specially to the Manager.

“Attention to Instrument” Signal.

29. When the “Train Off” Signal is not given for a very unusual period after a train has passed a Box, or the Electric Semaphore Arm is maintained at “Danger” a longer time than would appear to be necessary after the “Be Ready” Signal has been sent to the Signal-box in advance, the attention of the Signalman at that Box may be called to the instrument, by giving *eight* beats slowly and distinctly, on the plunger. This must be acknowledged by an exact repetition.

30. When the Electric Signal in a Signalman’s box remains on a longer time than usual, the Signalman should remember that that is just the time when he requires to be most careful. Signalmen sometimes are over anxious to prevent the detention of a Train, but they should bear in mind that *it is always better to delay a Train than to run the slightest risk of accident.*

31. When a Signalman has reason to think that a wrong Signal has been given from the Signal-box in the rear, the Signal  may be sent to call the attention of the Signalman in the rear, and to give him the opportunity of withdrawing the previous Signal and giving it correctly ; but it is better not to acknowledge an indistinct or doubtful Signal, and only to use this Special Signal in special cases.

“Inspection” Signals.

32. The Inspector’s Signal of *nine* beats on the Plunger is only to be used by that person for testing, examining, or changing the instruments, and is to be acknowledged each time by an exact repetition. Instruments should not be tested during such time as a Train is being signalled by them.

So soon as the inspection of the instrument is completed, *ten* beats will be given by the inspector, which is to be replied to by *ten* beats if the inspection is to be continued. and by *one* beat if the apparatus has been made right.

“Time” Signal.

33. Precisely at 10 o’clock, a.m., daily, on receipt of the Time Signal on the Speaking Instrument from the Chief Office, the time is to be sent from the Signal-box in circuit to the adjoining Block Signal

Station, by giving ten beats on the plunger of the Signalling Apparatus. The clocks are to be adjusted accordingly, and the Signal recorded on the Sheet. If the Signal is delayed a minute or two, the accurate time may be given to the next Box, by adding after the *ten* beats one, two, or three beats to denote (after a pause) the minutes past ten o'clock.

“ Assistance ” Signals.

These Signals may be used under the following circumstances, and as directed below, at a Signal Box where there is no Speaking (Telegraph) Instrument :—

34. To Call for aid when the Line is obstructed by an accident or other cause. { If the Semaphore Arm of the next Signal-box is not already at “ Danger,” give *Five Beats*—the Obstruction Signal—on the Red Plunger. On the acknowledgement of the Obstruction Signal, give *Five Beats* a second time, clearly and distinctly, upon the Plunger; and these are to be repeated back, clearly and distinctly from the next Box.

When a Relief Train, proceeding to the place of obstruction, reaches the Section on which the accident has occurred, the Signalman in charge is to allow the Relief Train (but not more than one Train) to enter the Blocked Section, having first brought the Engine to a stand, and having personally warned the Driver of the nature and place of obstruction. The Relief Train to be signalled forward, thus :—“ Train proceeding under Caution Signal” ●●—●●●●●●. When the Line is cleared of the obstruction which has blocked the Section, the greatest care must be observed in ascertaining that the Line is really clear, before the ordinary Train Signalling is resumed, on the All Clear Signal being given and repeated back.

35. To call for aid in case of sudden illness, or on an emergency, when personal assistance is required; but when the Line is not blocked, and there is no Train in the Section. { Give ten beats in *two groups of five beats* each, on the Free Key. These beats are to be repeated back from the next Box in a similar manner.

“ Train Running Back ” Signal.

36. In the case of a Signalman being aware of the fact of a portion of a Train having become accidentally detached, or a Train running back down an incline, he must immediately place his Signals for the opposite Line to Danger, and stop the next Train going in that direction, and instruct the Driver to proceed cautiously, as the Line may be obstructed. He must also call the attention of the Station in the rear, towards which the portion of the Train may be running, by giving *twelve* beats on the Red Plunger. The Signalman who has received this

Signal must stop any Train about to proceed on the same Line ; and he must take such protective measures as may be necessary, such as turning the runaway Train across to the other Line, or into a Siding, as may be most expedient under the circumstances.

“Divided Train Running Forward” Signal.

37. The “Divided Train Running Forward” Signal of *twelve* beats in groups of *three*, repeated *four* times, is only to be used in the event of a Signalman observing that a Train has become divided, and is running in two or more parts. The Signalman receiving this Signal must stop any Train travelling in the opposite direction ; and if the divided Train is running on a falling gradient, where the stoppage of the first part would risk a collision by the second part overtaking it, the Signalman must not exhibit the Danger Signal to stop the first portion, but must give the Driver a Green Signal, either by flag or hand lamp, waving such Signal from side to side, and must tell the Driver of the circumstances as he passes ; if the Train is running on a rising gradient, or when the Line is Level, the Signalman must stop the first portion and deal with it as expeditiously as possible to prevent the second portion coming into collision with it.

Should any Train going in the opposite direction have been stopped, it must be allowed to proceed after satisfactory evidence has been obtained that the Line on which it is about to run has not been obstructed.

“Train or Engine Running Away” Signal.

38. If a Train or Engine has escaped without any one on the Engine, and is running away forward on the right Line, the section in advance must be advised of the fact by giving *fifteen* beats on the Free Key, in groups of *three* beats repeated *five* times. The Signalman receiving this Signal must arrange for the Line on which the vehicles are running to be cleared, and take such other measures as he may consider most expedient under the circumstances.

“Switch” Signals.

39. At Signal Boxes which are closed between Saturday night and Monday morning, or during the night, switches are provided to enable the Boxes on either side to be put through when the Box is closed.

40. When the time for leaving duty arrives, the Signalman at a Switch-box, must not switch his apparatus out of circuit until the sections on each side are clear of Trains. When that is the case, the Signal of *eleven beats* on the Free plunger must be given to the Station on each side, and upon receiving the acknowledgments in reply the Switch may be closed.

41. Signalmen at a Junction Box, and which are next to a Box that switches through at a given time, must (when the time for leaving duty arrives) give the All Clear Signal, if there be no Train in the Section, so as to release the Signalman at the Switching Through Box. The Junction Rules and Rules 14 and 15 must be strictly carried out before All Clear is given.

42. Upon taking duty in the morning the Signalman is to open the Switch, and give notice to the Boxes he communicates with by *eleven* beats on the White plunger, which must be acknowledged from the Boxes on each side.

If the Sections are both clear at the time of opening, this is all that need be done ; but if a Train, &c., is in Transit on either Line the Boxes on each side must repeat to the Switch Station the Signals last sent previous to the opening of the Switch Station.

The Switch Station must forward these Signals, and only give the Train Off Signal when the Train or Trains have passed the Switch Station, or the Train Off Signal has been signalled from the end of the section, towards which the Train was travelling.

43. When the Signalman has switched his Box out of circuit, he must lower all his Signals to "All Right," put his Signal lights out, extinguish his fire and other lights, lock up the Box and deposit the key as instructed.

Lightning Storms.

44. All Telegraph Instruments are liable to disturbance during lightning storms. When therefore any unusual Signals upon the Bell or upon the Block Instrument with which it is in connection are observed, the Testing Signal may be given by the Signalman upon his "Free" key which will be answered by the Signal Box in connection, and will preserve or restore the indicators of the instruments at the position of the Signals last sent and received.

Electric and Out-Door Signals.

As relating to their respective positions

45. When the Electric Block Signal, worked from another Signal Station is at *Danger* in any Signalman's Box, the out-door Signal for the Line or Lines to which that Electric Signal applies must be also at *Danger*. When the Electric Signal in any Signalman's Box is off, the Out-Door Signals for the Line or Lines to which that Electric Signal is applicable must be off *except at Junctions*. When any Train is standing at a Station, or when any Line is obstructed, the Out-door Signals must be at *Danger*.

46. At the Signal-boxes the out-door Signals, and the Electric Semaphore Arm at the next Signal-box in the rear, must always be kept at *Danger* until the "Be Ready" Signal is given on the Block Telegraph

Instrument from the Station in the rear, when, if the Line is clear, the Block and out-door Signals may then be lowered for the approaching Train. If the Line is not clear, and there be any possible danger at fouling points, as mentioned in rules under Junction Absolute Block Working, the Signalman receiving the Be Ready Signal must return the Obstruction Danger Signal and maintain his Block and out-side Signals at Danger, until all obstruction is removed, when the All Clear Signal is to be given and the Train On Signal may be accepted from and acknowledged to the Station in the rear, and a Train be permitted to proceed.

47. After a Train has left a Station, and until it has arrived at or passed the next Station in advance, the Electric Signal will be at Danger as explained in Rules 14 and 15, consequently the out-door Signals which apply to the Line on which the Train has proceeded must also be at Danger and remain at Danger until the Electric Signal is taken off.

48. In the event of the Electric Signals getting out of proper working order, the *Blackboard* is to be hung up out-side the Signal-box, so as to be visible to any Line-man passing in a Train, and the attention of the Manager and Line-man is to be at once called to the circumstance by wire or other expeditious means.

49. When the Electric Signals are not working from any Station, the Signalman will stop Trains or Engines and advise the Drivers and Guards of the failure, and may then permit the Train or Engine to proceed cautiously to the next Signal Station. The usual Time intervals, prescribed in the General Rule Book, must be observed for Trains following each other during the suspension of Block Working.

50. When Signalmen change duty a line should be drawn across the book or sheet immediately beneath the last entry. The Signalman going off duty should sign his name above this line, accompanied by the remark "Off Duty" with the time at which he hands things over to his successor, as—"P. Murphy, off duty, 6 a.m." The Signalman who "takes on" should sign his name under the line, with the remark—"D. O'Toole, on duty, 6 a.m."

51. Every Signalman is held responsible for keeping his Signal-box strictly private, and he is not to allow any other person than the authorized Officers of the Railway Company or the Telegraph Department to enter or remain in it, otherwise he will subject himself to dismissal.

52. Station Masters and Inspectors are held responsible for seeing that these regulations are strictly carried out, and that the utmost vigilance and care is exercised by all concerned, in order to ensure safety.

[SANCTIONED AND APPROVED OF BY THE BOARD OF TRADE.]

◁ STROUDLEY'S ▷

Patent Electrical Apparatus

FOR COMMUNICATING BETWEEN

PASSENGERS AND GUARDS, GUARD AND GUARDS, AND GUARDS AND
DRIVER, IN A RAILWAY TRAIN.

As in use on the London Brighton and South Coast, and Victorian
Government Railways.

THE universally admitted importance of every passenger train being fitted with an effective means of enabling passengers to call the attention of the guards of a railway train in motion, in case of danger or alarm or from other urgent cause or necessity, has been demonstrated so repeatedly that no apology need be offered for calling special attention to a very simple, inexpensive and efficient apparatus for this purpose. This invention has stood the test of running, under severe trials, for several years on the London, Brighton and South Coast Railway system, and has been selected from numerous competitive apparatus, and ordered by the Board of Directors for general adoption on the whole of the rolling stock of that Company. As this apparatus is the invention of well-known and thoroughly practical railway officers, the foregoing result was to be expected.

Numerous mechanical methods have from time to time been introduced, all of which fell short of the most essential requirements, *i.e.*, a ready and instantaneous means of communication *between guard and guard*, in addition to the passenger means of calling the attention of the guards and driver, as it is well known that the guard or guards in the after part of a train cannot at all times hear the engine whistle, when sounded for the brakes to be applied, or when whistling for the signal. Now, by this means of communication, a code of signals is maintainable throughout a journey; one sharp ring on the bell given and repeated meaning "**All right;**" two sharp rings, "**Look out. Be ready to apply the brakes;**" three rings, "**Slip carriages at speed;**" or a continuous ringing, "**Use all means for stopping the train.**" For instance, a signal is against the train; the driver whistles for the signal, and the front guard rings the bell twice. Now

the after-guard may be sorting luggage or parcels. These he would immediately leave, and repeat the two rings back on the bell, looking himself for the signal, although, from the state of the weather, or any other cause, he could not at all times see it. During the interval the signal may be taken off, when the front guard would immediately give one sharp ring, which would be repeated by the after-guard, and the journey resumed.

A simple interchangeable key or pull, which enables passengers to communicate, is provided in each compartment or carriage. This pull when withdrawn cannot be restored to its original position by the passenger; the bells, therefore, continue ringing, until the train is stopped, and thus the compartment or carriage from which the signal has been rung can be ascertained.

The bells in the guards' vans are each provided with their own batteries, and are, like the whole of the apparatus, interchangeable, so that a bell will suit any break-van, and the electric circuit is completed by lowering the bell instrument into two bracket pieces. The bells are also provided with a clamp-piece, which may be attached to the ordinary cord communication, thereby enabling the bell to be universally employed either for the communication at present in use, or for electric communications generally.

Electric "slip couplings" are used for slip portions of a train. These do away with the necessity for stopping a train when the weather is foggy or hazy, as the slip portion gets the signals for slipping by bell signal from the front-guard, these are repeated back by the second-guard when the train is severed.

The accidental separation of a train is also made to give its own signal to the guards for stopping the several portions of a train, if required. This contrivance may also be used with the ordinary cord communication, without the electric keys in the compartments.

Each carriage, with its fittings, is complete in itself, and is readily connected or disconnected from any portion of a train.

The apparatus may be inspected, by permission of W. Stroudley, Esq., Locomotive Superintendent, Brighton, or on application to the Sole Manufacturers.





GARNHAM & COMPANY,

TELEGRAPH ENGINEERS,

Manufacturers of Harper's Patent Block or Space Signalling Interlocking
Telegraph Instruments, for the Prevention of Errors in
Signalling (One-Wire System.)

SASH COURT, WILSON STREET, FINSBURY,
LONDON, E.C.



CODE OF ELECTRIC SIGNALS

Signification.	Given by Station.	
Acknowledgment Signal	A or B	●
"Warning Signals."		
Be ready for a Passenger Train, or Relief Train or Engine ...	A	●—●●
Be ready for a Goods, Cattle, Coal, or Through Ballast Train, or Single Engine	A	●●—●
For a Ballast Train Stopping in the Section	A	●●—●—●
† Engine assisting at rear of Train	A	●●—●●
"Block" Signals.		
Train On	A	●●
" " " Branch Line Train (Junction Signal)	A	●●●
Train Off	B	⊖⊖⊖⊖
Obstruction Signal—Danger	A	⊖⊖⊖⊖⊖
All Clear Signal { In reply to a Warning Signal (<i>see Rules 5 & 46</i>)... When obstruction is Removed (" " 17 & 18)...	B	○●—○●
	A	○●—○●
"Occasional" Signals.		
Cancelling Signal	A	●●●●●●
Special Attention Signal—Stop and Examine Train (to Box in advance)	A	●●●●●●
Special Attention Signal—Train passed without Tail Lamp (to Box in rear) ...	A	⊖⊖⊖⊖⊖
Train proceeding under Special Caution Signal (<i>see Rules 27 & 32</i>) ...	A	●●—●●
Attention to Instrument Signal (to Box in advance)	A	●●●●●●
" " " (to Box in rear)	A	●●—●●
Shunt Train for another Train to pass	A	●●●●●●
Inspection Signal—commencing Inspection	A	●●●●●●
" " closing Inspection	A	●●●●●●
Time Signal—At 10 o'clock, a.m., daily	—	●●●●●●
Assistance Signal—when Line Obstructed	A	{ Obstruction— ⊖⊖⊖⊖⊖ and when ac- ⊖⊖⊖⊖⊖
" " when Line Not Obstructed	A	
Switch—Opening or Closing Signal	A or B	●●●●●●
Train Running Back in wrong direction	A	⊖⊖⊖⊖⊖
Divided Train Running in proper direction	A	●●●—●●
Train or Engine Running Away in proper direction	A	●●●—●●

The dots represent the Plungers or Keys to be pressed in making the Signals, viz.:—⊖ indicates by which the "All Clear" Signal is transmitted; and ● means either Key which may be unlocked.

* Station A is the Box on the spot, and Station B the Box in advance, towards which the Train is proceeding.

† *Engine Assisting*.—When a Train is assisted by an Engine in the rear, the Train must be shunted immediately after the Train has entered the Section, and the Signal "Train On" has been sent. The "Train Off" Signal must not be given until the Train has been shunted or otherwise properly protected by the Signals.

ERIC SIGNALS.

How given in Beats.	Given by Station *	How acknowledged in Beats.
(One)	A or B	●
(One—pause—Two)	B	○○—○○
(Two—pause—One)	B	○○—○○
(Two—pause—One ;—given Twice)	B	○○—○○
(Three Twos)	B	①
(Two)	B	①
(Three)	B	①
(Four)	A	●
(Five)	In rear	●●●●●
(Two—pause—Two)	A	●
(Two—pause—Two)	In rear	●●—●●
(Six)	B	○○○○○○
(Seven)	B	①①①①①①①
(Five—pause—Two)	In rear	●●●●●—●●
(Two—pause—Five)	B	①①—①①①①①
(Eight)	B	①①①①①①①①
(Four Twos)	In rear	●●—●●—●●—●●
(Seven—pause—Two)	B	●
(Nine)	B	●●●●●●●●●
(Ten)	B	● or ●●●●●●●●●●
(Ten)	—	●
(Five)	{ B }	●●●●●
(Five a Second Time)	{ B }	●●●●●
(Five given Twice)	B	●●●●●—●●●●●
(Eleven)	A or B	●●●●●●●●●●●
(Twelve)	In rear	●
(Four Threes)	B	①
(Five Threes)	B	①

As the Red Key (by which the "Train On" Signal is accepted); ○ indicates the White Key at the time at the Station sending the Signal.

It is supposed to be running in the usual course.

Called in the usual manner by the "Be Ready" Signal, denoting the description of Train, and "Engine Assisting" Signal must also immediately be given on the Plunger, which is to be until the Engine assisting at the rear of the Train has arrived at the Box in advance, and been

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